

**Implementation of the Watershed Based Plan for AMD Remediation
in the Cheat River Watershed, WV**

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Muddy Creek WVMC-17
Martin Creek WVMC-17-A
Fickey Run WVMC-17-A-0.5
Glade Run WVMC-A-1
UNT/Glade Run WVMC-17-A-1-A
UNT/Glade Run WVMC-17-A-1-B

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ABSTRACT

The Watershed Based Plan recently completed by Friends of the Cheat (FOC) provides for the first time a basis to optimize resources in restoration of the Muddy Creek watershed, the largest contributor of acid mine drainage (AMD) to the lower Cheat River. Ongoing assessment and mapping work by FOC, and West Virginia University (WVU) will be integrated to strategically identify locations for application of a combination of both active and passive AMD treatment technologies. The efficacy (cost and ecological benefit) of the treatment approaches will be evaluated to provide a framework to guide further restoration activity in the Cheat River watershed. Project outcomes include removing six stream segments from the 303(d) list, enhancing ongoing environmental educational activities in the community and restoration of a cold water fishery.

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PROJECT DESCRIPTION

Introduction

Friends of the Cheat (FOC) is a 501 (3)(c) watershed organization dedicated to restoring the physical, chemical and biological integrity of the 1, 426 square mile Cheat River Basin of North Central West Virginia. The dominant water quality impairment of this watershed is acid mine drainage (AMD) that contributes metals (iron, aluminum and manganese) creating acidity and lowering stream pH. AMD is an insidious pollutant that causes loss of fish and wildlife, aesthetic impairment due to unsightly orange stains on river substrates, degrades public water supply and limits opportunities for recreation and economic growth. A 2001 EPA TMDL established acidity and metal loadings for 55 stream segments, encompassing 238 stream miles in the lower Cheat watershed.

Friends of the Cheat was formed in the spring of 1994 in response to a catastrophic AMD release to Muddy Creek from a recently closed coal mine. The founders recognized that the scope of the AMD problem in the watershed extended far beyond this single catastrophe, and that coordination of all available public and private resources would be needed to effectively restore the watershed. As a result, local industry, state and federal agencies and other citizen groups formed a *private-public partnership* known as the *River of Promise* (ROP). Founded in 1995 with initial signatories FOC, West Virginia Rivers Coalition, Anker Energy, the National Mine Land Reclamation Center at West Virginia University, West Virginia Department of Environmental Protection (WVDEP), West Virginia Division of Natural Resources (WVDNR) and the U.S. Office of Surface

Mining, the ROP task force is a diverse and dynamic coalition organized and led by FOC.

The partners in ROP share a commitment to restore the Cheat River, to provide diverse recreational opportunities and to grow and sustain viable local economies.

Watershed Characteristics

The Cheat River Watershed flows approximately 162 miles from its southernmost headwaters in Pocahontas County, West Virginia north into Pennsylvania where it joins with the Monongahela River just north of the West Virginia/Pennsylvania Boarder. The 1,426 square mile watershed is primarily rural in character with a population density of approximately 32 persons/square mile. The watershed is dominated by deciduous forest and agricultural lands and the local economy is based on coal mining, timber harvesting, recreational development and agricultural activities. The majority of the coal fields are located in the northern counties (Preston, Monongalia and Tucker) significantly impairing water quality in the lower Cheat River.

The Cheat River supports a healthy aquatic ecosystem upstream of Rowlesburg WV.

Downstream of Rowlesburg, however, AMD from seven major tributaries severely degrades water quality 20 miles downstream to Cheat Lake. The acid tributaries: Pringle Run, Lick Run, Heather Run, Morgan Run, Muddy Creek, Greens Run and Bull Run contribute about 86% or about 10,600 tons per year of acid load to the lower Cheat River.

Goal of the Lower Cheat Remediation Program:

The goal of the Lower Cheat Remediation Program (LCRP) is to implement the Cheat TMDL by providing sustainable, long-term remediation of AMD pollutants to the main stem of the Lower Cheat River watershed downstream of Rowlesburg, WV. To date,

FOC has secured funding and constructed six passive treatment systems on four tributaries. Most dramatic in improvement has been Little Sandy Creek which produced one species in a WVDNR survey in 1989 and 14 species in 2001. Currently FOC has three remediation projects funded and going to construction this year and an additional three projects planned for 2006.

Watershed Based Plan

In February 2005 the Friends of the Cheat (FOC) completed a Watershed Based Plan (WBP) for ten tributaries of the lower Cheat that will guide future restoration activities in the watershed. It identifies (to the degree existing data allow) 66 of a total of 239 Abandoned mine lands (AMLs) and 47 bond forfeiture sites that are significant sources of AMD to the lower Cheat. Given the current status of water quality data and inventory of sites, the WBP estimates that at a minimum \$ 21.5 M is required to remediate known AMD sources. For a full cost estimate, additional monitoring and assessment is needed.

Restoration Strategy

The WBP now provides, for the first time, the opportunity to strategically plan the optimization of restoration activities to implement the 2001 TMDL. This proposal focuses on restoring Muddy Creek, the largest sub-watershed tributary to the lower Cheat, which contributes an estimated 6000 tons/year of acidity and 67 tons of iron and aluminum primarily from three major tributary drainages: Fickey Run, Glade Run and Martin Run as well as an upstream section of Muddy Creek. A total of 27 stream miles in the Muddy Creek drainage are impaired by AMD. According to the WBP Fickey Run is impaired by 2 AML and 3 bond forfeiture sites and Glade is impaired by 5 AML and 3 bond forfeiture sites. Both Fickey and Glade empty into Martin Run which receives

AMD from 2 identified AML sites before it joins Muddy Creek at milepoint 3.2.

Approximately 0.7 mile upstream of the Martin Creek tributary, Muddy receives AMD from several AML sources originating from Dream Mountain. Upstream of Dream Mountain, Muddy Creek supports a quality cold water fishery. The Dream Mountain AMLs that drains directly to Muddy are being addressed this year (2005) with funding provided by WVDEP/Non-Point Source Program and OSM Cooperative Watershed Agreement Program. Two OSM Cooperative agreements for this project totaling \$200,000 serves as a portion of the cost share for this proposal.

Project Objectives

The primary objective of this project is strategically optimize resources in implementation of the Muddy Creek watershed portion of the Cheat River TMDL by restoring water quality in 27 stream miles (six 303(d) listings) and assessing the resulting ecological benefit to the Lower Cheat River. The secondary objective is to evaluate and compare the efficacy (cost and ecological benefit) of four approaches for remediating AMD: application of appropriate and proven passive treatment technology at individual AMD sources; application of lime dosers to individual AMD sources; application of lime dosing in the stream channel; and application of a combination of passive source treatment and in-stream lime dosing (hybrid approach). It is anticipated that the outcome of this project will provide a framework for AMD remediation in the remaining six impaired sub-watersheds in the lower Cheat Watershed.

Project Rationale

Application of passive treatment technology at individual AMD sources has been the basis of the ROP restoration approach primarily because state and federal funding sources have not heretofore provided funding for treatment system maintenance and a WBP providing for a more systematic restoration approach had not been completed. Experience has shown that construction of passive treatment systems to treat individual sources can be expensive due to the large number, diffuse nature and spatial distribution of AMDs. Moreover, landowner access agreements can be difficult or impossible to obtain and construction of access roads to remote locations are costly. Furthermore, due to the uncertainty associated with the long term effectiveness of existing passive technologies, it is becoming increasingly evident that it will take much longer and cost much more to implement the TMDL and restore the Cheat River through passive at-source treatment alone.

Like most enterprises, water treatment benefits from economy of scale. Ideally, if it was physically possible to consolidate all or most AMDs within a watershed, as is the approach with municipal wastewater treatment, and construct one large treatment system significant cost savings and environmental benefits would result at a much faster rate. A recent study completed by the National Mine Land Reclamation Center (NMLRC) for the WVDEP Office of Special Reclamation demonstrated significant cost savings, as one would expect, and projected increased environmental benefit by applying lime dosers at strategic locations within the stream system rather than applying lime dosers at each individual source.

The WBP now provides the framework for developing information necessary to address AMD sources holistically on a watershed scale. Moreover, The WVDEP 10% Set Aside and Office of Special Reclamation programs now provide funding to support treatment system operation and maintenance based on completed hydrologic unit plans. Therefore, opportunity exists through this project, with the cooperation and support of WVDEP/Special Reclamation and OSM to holistically restore the water quality in the largest sub-watershed in the Lower Cheat and at the same time evaluate the efficacy of the various AMD remediation approaches on a watershed basis. Since AMD problems are formidable and funding and other resources are limited, ROP believes that it is timely to focus and evaluate its traditional restoration approach to determine the most cost effective and ecological beneficial approach to AMD watershed reclamation.

Project Approach

Target three major AMD impaired tributaries of Muddy Creek watershed and an impaired segment of Muddy Creek above Martin Run tributary:

- a. Fickey Run-* Fickey Run is 2.6 miles in length, draining 1.78 sq. miles. The AMD impairment originates from three bond forfeiture sites in upper watershed. An Aqua-Fix lime doser will be strategically located in cooperation with and cost shared funded by WVDEP Special Reclamation.
- b. Glade Run-* Glade Run drainage includes 3.6 stream miles draining 3.7 sq. miles. AMD from several AML and bond forfeiture sites causes 2.8 miles of stream impairment. Based on initial reconnaissance, drainage from these AMD sources will be combined and treated with a combination of passive treatment and an in channel Aqua-Fix lime doser. The lime doser will be purchased with a

\$100,000 OSM Cooperative agreement and maintenance will be provided by the WVDEP Set-Aside fund. This funding will serve as partial cost-share.

c. Martin Creek- Martin Creek is 2.2 stream miles and drains 1.65 sq. miles.

AMD originates from five bond forfeiture sites throughout the watershed. Aqua-Fix lime dosers have been recently installed by WVDEP Special Reclamation at each source. Capital and long term maintenance costs are known.

d. Muddy Creek- Only 0.7 mile of Muddy Creek upstream of Martin Creek is AMD impaired by several AMD sources emanating from Dream Mountain Game Ranch. Various seeps and sources will be combined in an open limestone channel and passive treatment constructed with funding from WVDEP/Non-Point Source Program and OSM Cooperative Watershed Program.

Tasks and Schedule

Year 1.

Task a. Initiate a monthly water quality monitoring and April and October macroinvertebrate sampling at 13 locations on respective streams. This will build on data gathered in 2005 by FOC and funded by WVDEP/Non-Point Source Program.

Task b. Continue GIS mapping of water quality data from multi-agency sources, FOC monitoring and ongoing EPA STAR research project. Determine and plot site and cumulative downstream loadings for Muddy Creek watershed. Assess and prioritize sources. This mapping project was initiated by FOC in 2004 and will provide data preceeding this project period.

Task c. Develop conceptual designs for at-source and in-stream treatment systems for respective stream segments and AML and bond forfeiture sources.

Task d. Develop hydrologic unit plan (HUP) for Muddy Creek and tributaries in order to qualify for 10% set-aside maintenance funds from WVDEP.

Year 2.

Task a. Continue monthly water quality monitoring and April/October summer macroinvertebrate survey.

Task b. Continue with GIS mapping of water quality data and assessment of priority sites for acid reduction.

Task c. Design and construct AMD passive treatment systems for Muddy Creek and Glade Run; install instream lime doser on Fickey Run and Glade Run.

Year 3.

Task a. Continue monthly water quality monitoring and April/October macroinvertebrate survey.

Task b. Integrate water quality, macroinvertebrate data into ongoing EPA STAR research data to determine net ecological benefit to Muddy Creek and lower Cheat River.

Task c. Compare ecological and other benefits resulting from four treatment approaches to capital and maintenance costs.

Task d. Prepare final report.

Performance Measurement

Project performance will be measured by the following criteria:

Number of stream miles in Muddy Creek watershed meeting water quality standards and removed from the 303(d) list; 2. Remediation approach cost = \$/ton of pollutant removed on an annual basis and; 3. Environmental benefit (in both Muddy Creek and the lower

Cheat River) = macroinvertebrate community recovery based on the WVDEP Stream Condition Index (SCI) score and monthly water quality monitoring for TMDL pollutants.

Environmental Outcomes

The intended outcome of this project is restoration of 28 stream miles in the Muddy Creek watershed resulting in significant improvement to water quality in the lower Cheat River. Additionally, the results will indicate to ROP the most cost-effective and ecologically beneficial approach to use in restoring six other AMD impaired tributaries to the Lower Cheat River. Furthermore, if in-stream dosing is documented to be more cost-effective *and* ecologically beneficial, the results may positively influence AMD reclamation policy to provide additional funding for treatment system maintenance.

Alignment with Ongoing Programs

This proposed project is consistent with the EPA Watershed Approach which encourages the application of holistic and innovative approaches to watershed restoration for TMDL implementation. It integrates support from state and federal AMD reclamation programs to demonstrate the most cost-effective and ecologically beneficial approach to restore AMD impacted watersheds.

Cost share for this proposal will be contributed by the WVDEP Division of Mining and Reclamation Office of Special Reclamation who has committed to contribute the capital and maintenance cost of the Aqua-fix lime dosing unit on Fickey Run. This contribution is approximately \$ 100,000 capital and \$200,000 maintenance over 20 years.

Additionally, OSM will provide \$ 400,000 in the form of four Watershed Cooperative

Agreements on the Dream Mountain site and on Glade Run. The WVDEP AML Set-Aside fund will provide for lime doser maintenance on Glade Run.

Outreach and Education Activity

1. The results of the monitoring, mapping, assessment and evaluation of biological restoration will all become parts of ongoing educational activities with area schools, 4-H Camps and Scouting programs. Specific sites will be available for field trips supporting these activities.
2. The .7 mile of projected restored fishery on Muddy Creek adjoins existing interpretive signage educating the public on AMD and stream impairment. This section will be open for public fishing with easy access from the interpretive area. Additional interpretive signage will be developed describing the restoration work resulting in a restored section of Muddy Creek.
3. Reports on the project will be posted on FOC website, available for publication to EPA, WVVRI.
4. Model for monitoring, GIS mapping and assessment for watershed problems.

Budget

Appendices (in addition to 10p proposal)

*Letters of support/matching funding-WVDEP special Rec and AML, OSM, NMLRC for technical support

*Map of watershed and proposed work areas